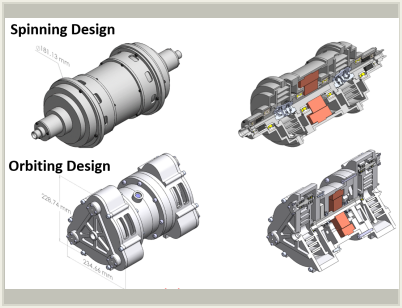
High Capacity Multi-Stage Scroll Compressor for Mars Atmosphere Acquisition, Phase I

Completed Technology Project (2017 - 2017)

Project Introduction

There are several ways to capture and pressurize CO2, including freezing at cryogenic temperatures, mechanical compression, and absorption. Completed studies on each approach, have generally favored cryogenic temperature and mechanical compression solutions. Recently, mechanical compression has gained momentum through the Mars Oxygen ISRU Experiment (MOXIE), which utilizes an Air Squared compressor for mechanical compression of CO2. If this approach is pursued further for a larger system, there are still several questions concerning reliability over 10,000 hours of autonomous operation in Mars environment and scalability. Air Squared plans on addressing these issues as part of Phase I. Air Squared proposes the development of a Multi-Stage Scroll Compressor (MSSC) that will be configured to support a store-and-utilize strategy (high pressure) or a collection-only strategy (high flow). If a store-and-utilize approach is required, the MSSC will be set up to pressurize the gas over the triple point (>77 PSIA), which provides the ability to liquefy CO2 downstream of the MSSC as it cools, while N2 and Ar remain a gas. If only collection is necessary, the MSSC will be configured to maximize flow at a pressure above 15 PSIA. There will be two 'types' of MSSCs pursued during the Phase I, an orbiting and spinning MSSC. The orbiting MSSC has the advantage of longer design heritage and lowers associated risk, as this scroll configuration is widely used at Air Squared and the compressor industry as a whole. The spinning MSSC has the advantage of achieving an aggressive size and weight target but has little design heritage. The orbiting MSSC and spinning MSSC both have substantial advancement over state of the art mechanical compression technologies, such as high-speed turbo-compressors. Size, weight, and power requirements are all reduced. Reliability is also improved, as both MSSCs operate at significantly lower speeds than turbo-compressors.



High Capacity Multi-Stage Scroll Compressor for Mars Atmosphere Acquisition, Phase I Briefing Chart Image

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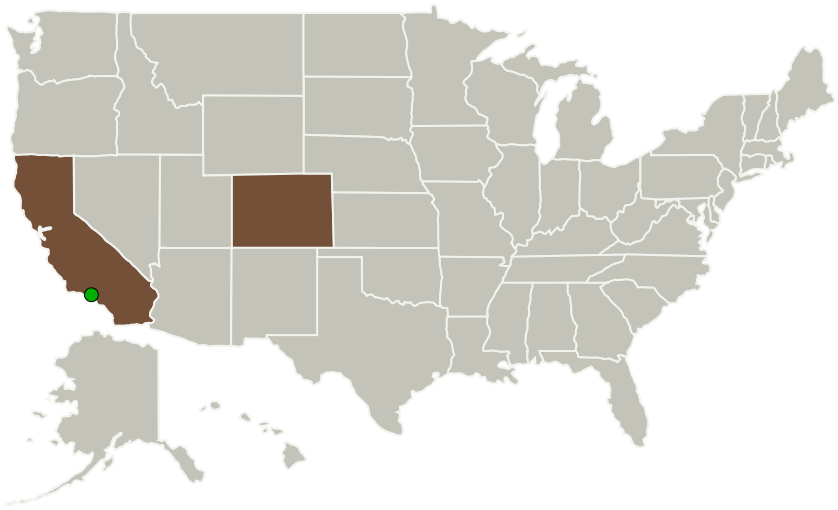
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Air Squared Inc.	Lead Organization	Industry	Broomfield, Colorado
Jet Propulsion Laboratory(JPL)	Supporting Organization	NASA Center	Pasadena, California

Primary U.S. Work Locations	
California	Colorado

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Air Squared Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

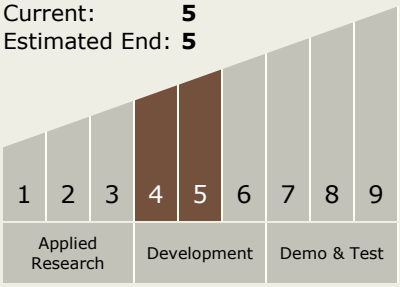
Carlos Torrez

Principal Investigator:

Bryce Shaffer

Technology Maturity (TRL)

Start: **4**
Current: **5**
Estimated End: **5**



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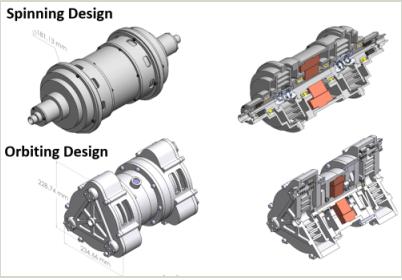
Images



Briefing Chart Image
High Capacity Multi-Stage Scroll Compressor for Mars Atmosphere Acquisition, Phase I Briefing Chart Image
(https://techport.nasa.gov/image/133804)

Technology Areas

Primary:

- TX07 Exploration Destination Systems
  - TX07.1 In-Situ Resource Utilization
    - TX07.1.2 Resource Acquisition, Isolation, and Preparation